

## The new normal dentistry in the COVID-19 pandemic world

COVID-19 and dentistry

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In December 2019, a new coronavirus disease mostly with the symptoms of pneumonia cropped out in Wuhan, China. The COVID-19 outbreak has spread out worldwide and it has created huge uncertainty. COVID-19 was announced by the World Health Organization as a pandemic on March 11, 2020, with infection cases occurring in 185 countries all over the world. There is no clear information about how long this pandemic will continue whether its different types will be seen, or whether it will reappear in the future. Dentists are in close contact with patients' blood, aerosol, droplet, and saliva during dental procedures. Therefore, dentists are at a high risk of being infected with COVID-19. During dental procedures, COVID-19 can be transmitted through inhalation of aerosols from an infected person or through contact with mucous membranes, oral fluids, contaminated instruments, and surfaces. The aim of this article is to collect all information about the COVID-19 outbreak that dentists should be aware of when they perform the dental practice.

**Keywords**

COVID-19; SARS-CoV-2; Pandemic; Dentistry; Oral surgery

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## Introduction

Coronavirus disease 2019 (COVID-19) is an infectious disease that spreads very quickly worldwide, and the etiological agent of this disease is SARS-CoV-2. This virus is different from SARS-CoV but both of them have the same host receptor (ACE2) [1]. The first cases of atypical pneumonia with symptoms of fever, cough, and shortness of breath that spread rapidly were reported in Wuhan, China in December 2019 [2]. The Chinese Disease Control and Prevention Center stated that on 8 January 2020 the pathogen of this disease was COVID-19 [1]. Although this pathogen was previously called 2019-nCoV, it was defined as SARS-CoV-2 later due to its taxonomic similarity to the virus which is the SARS agent. COVID-19 was announced by the World Health Organization (WHO) as an epidemic that threatened public health worldwide on January 30, but after that, it was proclaimed that this outbreak was a pandemic on March 11 in 2020, with infected cases occurring in 185 countries all over the world. According to the WHO, this pandemic is the first one which is procured by a type of coronavirus. Although the authorities have taken proactive measures to combat COVID-19, the number of cases is still increasing [2].

The COVID-19 pandemic has only a 7-month history, and this is a very short time so that there are many unknown features of COVID-19 now [3]. On the other hand, there is no clear information about how long this pandemic will continue, whether its different types will be seen, or whether it will reappear in the future [4]. While the outbreak in China has already been taken under control, many other countries are still struggling with a growing number of cases [5].

In humans and mammals, alphacoronavirus and betacoronavirus usually cause infections that are located at the central nervous system, respiratory and gastrointestinal systems, whereas both gammacoronavirus and delta coronavirus causes infectious in birds. COVID-19 is a member of betacoronavirus subgroup. Although COVID-19 is in the same subgroup as SARS-CoV and MERS-CoV, according to the current studies, the genetic similarity rate of COVID-19 with them is below 80% but COVID-19 has a significantly higher transmission rate than the others [6]. On the other hand, the mortality rates of COVID-19 are lower compared to SARS and MERS-CoV [5].

### *Epidemiology and transmission ways of COVID-19*

ACE2 is the host receptor when COVID-19 enters into the body. Therefore, cells in which ACE2 is released in the body are the target cells for COVID-19, and there is an increased risk of infection. Type II alveolar cells in the lungs, enterocytes in the colon and ileum and multilayer epithelial cells in the esophagus and proximal tube cells in kidneys are the cells in which the most of the ACE2 is released in the body [2].

According to the current studies, COVID-19 is thought to be transmitted from animals to humans [7]. It was determined that the primary origin of COVID-19 was isolated in *Rhinolophus affinis* bats. In addition, in another study made by South China Agricultural University, it was found that there was a 99% genome similarity between  $\beta$ -CoV viruses isolated from pangolins and COVID-19, so that this animal species was thought to be an intermediate host for this virus. Furthermore, the COVID-19 outbreak was reported to have been continuously transmitted from person to person shortly after the transmission from ani-

mal to person [8].

Different transmission routes of COVID-19 from person to person are defined [3]. COVID-19 is mostly transmitted with cough, droplet inhalation, sneezing, and contact with the contaminated eye, nasal or oral mucosa. Large size droplets cause transmission between people at close range, while smaller size droplets with air suspension cause a relatively longer distance transmission [3]. In addition, there is a possibility of fecal-oral transmission for COVID-19, as researchers have detected COVID-19 in patients' faeces in China and the United States [8].

Since many laboratory diagnostic tests are performed by taking blood samples, there is also the risk of contamination through contaminated blood [3].

While symptomatic patients are the primary source of transmission, people who show no symptoms but carry COVID-19 are also reported to be a factor in the transmission of the virus. This epidemiological feature has made the control of COVID-19 extremely difficult because people who have been infected with COVID-19 need to be identified and quarantined from the community. Asymptomatic COVID-19 patients who are not detected cause accumulation of COVID-19 in the community [8].

Transmission from mothers to their newborn babies has not yet been verified [9]. On the other hand, in a recent study, van Doremalen et al. [10] reported that COVID-19 can survive on copper and paper for 4-24 hours but it can also be inactivated by disinfection using either 0.1% sodium hypochlorite or 62-71% ethanol for 1 minute [11].

Since the end of January 2020, Chinese authorities have recommended people not to go to crowded places and stay at home as much as possible to prevent cross-infection [12].

Wu et al. [13, 14] reported in a meta-analysis of 1527 patients that COVID-19 has a mortality rate of 2.3%. Reproduction number (R0) is a marker of transmission of the virus and indicates the average number of newly infected people who are effectuated by an infectious person in a population [15]. COVID-19 has an R0 which is between 1.4-5.5 [16]. Although the mortality associated with COVID-19 is less, its spreading potential is high. Because of its high potential risk of spreading, many countries have closed teaching institutions, social meetings, sports activities, events and airports to take under control the spread of the COVID-19 pandemic. Moreover, many people have gone to self-quarantine [17].

High relative moisture and temperature substantially reduce COVID-19 transmission. It is reported that one-degree-Celsius increase in temperature decreases R0 by about 0.023 in China and 0.020 in the U.S, and one percent increase in relative humidity decreases the relative value by 0.0078 in China and 0.0080 in the U.S. Authors also stated that in the northern hemisphere, when it is hot and rainy, COVID-19 transmission will prominently decrease [18].

### *Clinical findings of COVID-19*

Current studies and WHO declaration state that the incubation period of COVID-19 lasts from 1 to 14 days, with an average of 5-6 days [19]. The 14-day period is confirmed as a time frame in order to make medical investigation and to put people who have been potentially exposed to COVID-19 during quarantine [6].

However, there are some case reports in the literature that

state that the incubation period of COVID-19 has extended up to 24 days [20]. The potential for longer incubation time has important implications for quarantine policies and inability to prevent the spread of the outbreak. Due to the sudden increase in the number of cases, the number of studies investigating the clinical and epidemiological features of COVID-19 is rapidly increasing [8].

Huang et al. [21] first identified the clinical findings of COVID-19 in 41 people who have worked or visited a local seafood and live animals market in Wuhan. The main clinical signs of this disease are shortness of breath, cough, and fever. Apart from these symptoms, there are also non-specific symptoms of COVID-19 such as conjunctivitis, sore throat, headache, hemoptysis, stomachache, dizziness, nausea, diarrhea, vomiting, fatigue, and muscle pain [22]. Although the loss of sense of both smell and taste was not initially confirmed as symptoms of COVID-19, recent studies in the literature reported that olfactory and gustatory disorders were symptoms of COVID-19 in Europe [23].

Computed tomography images of the patients infected with COVID-19 have ground-glass opacity and mostly irregular shadows in the lungs [8]. COVID-19 does not have any eye symptoms as a clinical finding, but the evaluation of conjunctival specimens obtained from both approved and suspected of COVID-19 cases shows that transmission of the virus is not localized only in the respiratory tract. COVID-19 has a high potential risk to penetrate to the body through eye exposure [16]. Approximately 80% of all cases are mild and can heal spontaneously without any treatment. On the other hand, approximately 15% of cases are classified as seriously ill, and the remaining 5% of cases are classified as critically ill. In cases classified as critically or severely ill, COVID-19 can cause serious breathing problems, kidney failure, or death [24].

COVID-19 is seen in all age groups and in patients with chronic systemic diseases, such as chronic respiratory disease, diabetes, cancer, cardiovascular disease, and immune suppression. Moreover, age over 65 years worsens the disease and also increases mortality rates [25]. In their retrospective study, Chen et al. [24] declared that the majority of COVID-19 cases had chronic systemic diseases such as diabetes, cerebrovascular and cardiovascular disease and the risk of being infected with COVID-19 was found to be higher in older men patients with weakened immune systems and chronic diseases. In a similar study, Wang et al. [26] reported that patients who were hospitalized due to COVID-19 were evaluated and the average age of the patients treated in the intensive care unit were found to be older than other patient groups, and also it is reported that many of COVID-19 patients had more than one chronic systemic disease. In addition, Li et al. [14] reported that mortality rate is obviously higher in patients with hypertension, diabetes mellitus, and cardiovascular diseases with 6%, 7.3%, and 10.5 % respectively.

Diagnosis of COVID-19 should be done appropriately through a combination of anamnesis findings, such as travel to an infected place in the last 14 days, CT imaging results and also laboratory tests. While recent international travels were a critical finding in the anamnesis taken from the patients at the beginning of the pandemic, this problem has lost its importance since

many airports around the world are currently closed [16, 27]. Saliva diagnostic tests are often used to detect COVID-19. It is stated in the literature that some virus strains can be detected even 29 days after infection [3]. In a recent study, To et al. [28] stated that viral cultures of COVID-19 were detected in saliva, and therefore saliva tests were reported to be a non-invasive method that gives reliable results during the diagnosis and follow-up of the virus. Virus RNA has also been isolated from plasma [9]. In addition, when diagnosing patients infected with COVID-19, a detailed anamnesis regarding exposure to identified risk factors should be taken, vital signs should be measured, clear symptoms should be detected, lungs should be evaluated in terms of the ground-glass image in bilateral chest tomography and methods of detecting COVID-19 by RT-PCR should be consulted. RT-PCR tests are used for the qualitative determination of nucleic acid from COVID-19 achieved from oropharyngeal or nasopharyngeal swabs [3]. The specimen of both blood and faeces can also be used for the analysis of COVID-19 using RT-PCR tests. RT-PCR is currently the only valid diagnostic method worldwide [29]. One negative test result does not indicate that a patient is not carrying the virus. Clinicians should carefully review patients' anamnesis findings, symptoms relevant to COVID-19, and CT results [27].

Unfortunately, the vaccine has not yet been developed to treat COVID-19 [16].

Mild cases of COVID-19 do not need any specific care and, generally, both home isolation and symptomatic treatment are enough, whereas oxygen therapy is a very important treatment for seriously ill patients. Furthermore, intensive care is also necessary for the treatment of critical cases with an average hospitalization duration of ten days [7, 9, 11].

Nowadays, a combination of azithromycin and hydroxychloroquine or convalescent plasma (CP) treatment has been presented as an alternative method for COVID-19. In this treatment method, CP is obtained from a person who has healed from COVID-19, producing humoral immunity. A potential source of particular antibodies of human origin is the advantage of CP for the prevention and treatment of COVID-19. Even so, it is very difficult to clarify the efficacy of CP, since in the literature, there are not enough studies on this method of treatment [16, 30].

Knowing these symptoms and alternative treatment methods helps healthcare professionals identify people infected with COVID-19. Any of the symptoms may appear within 2-14 days after being infected with COVID-19 [27].

#### **Dental practice and COVID-19**

In the oral cavity, there are cells which have capable of expressing ACE2 localized in the tongue, buccal mucosa, gum, and salivary gland ducts. Apart from this, COVID-19 is detected in saliva, which means the oral cavity is very risky in terms of the virus transmission [28]. On the other hand, epithelial cells of the salivary glands have the potential to be infected with COVID-19 and become the largest source of this virus in saliva [9]. Due to COVID-19, private dental clinics, and dental departments at universities and hospitals are closed all over the world, and some of them currently accept only urgent cases. In addition, this pandemic has procreated many academic strategies in dentistry faculties to sustain the guidance and sustainability

of academic terms [31].

Dentists are in close contact with patients because of the usage of dental equipment and devices such as ultrasonics, air turbine handpieces, and air-water syringes. Therefore, dentists have a high risk to be infected with COVID-19. During dental procedures, COVID-19 can be transmitted by inhalation of aerosols from the person infected or by contact with mucous membranes, oral fluids, contaminated instruments, and surfaces. [32].

Dentists and other healthcare professionals may be in direct contact with patients who have been infected with COVID-19 but have not been diagnosed [3]. The Chinese Infectious Disease Information System reported that COVID-19 was transmitted to 1716 health care workers and five of them have died during this pandemic. Providing both health and personal care to healthcare workers is required because an infected health care worker is supposed to be a source of cross-infection [33]. In a recent study, it is reported that 29% of 138 patients treated in the hospital for COVID-19 infection are healthcare workers [26]. In addition, it should be proven whether healed patients are a potential source of transmission or not [34]. The dentist, who was found to be infected with COVID-19, was reported firstly at the Wuhan University Dental Hospital in China on 23 January 2020. Later than, 8 other dental workers in this hospital were found to be infected through that infected person [35].

Too many health regulatory bodies worldwide have recommended dental practitioners to perform only urgent dental procedures and stop all elective treatment such as restorations and extraction of asymptomatic teeth, orthodontic adjustments, routine radiograph and aesthetic dental procedures [7]. Dental urgencies are specified as potentially life-threatening cases such as bleeding that is not under control, cellulitis with swelling that could plug airways, temporomandibular joint dislocation, and facial trauma with potential airways involvement. Severe dental pain and conditions such as pericoronitis of wisdom tooth and surgical post extractive osteitis should also be considered as urgent cases [11].

Restrictions on elective treatment should be taken into account because they reduce the spread of COVID-19, but at the same time they have caused serious financial problems for dental practices globally. In a recent survey conducted by the Irish Dental Association (IDA), 369 dentists participated, approximately one-fifth of the participants closed their clinics during pandemic temporarily or permanently, and about three-fourth of them expect economic losses of about 70% during the pandemic [7]. Dentists have been recommended to take a lot of personal protection precaution and prevent or decrease dental operations which produce droplets [1]. There is no universal protocol valid for dental care precaution during the pandemic. Deficiency of guidelines may cause an increase in COVID-19 spread through dental procedures [9].

During this pandemic, a telephone triage should be performed to determine the risks and severity of the patient's condition. The following questions should be asked over the phone call to prevent potential infectious patients to come to the clinic and spread the infection.

- Have you had a cough, fever or shortness of breath in the past 14 days?

- Have you had contact with people who have been infected with COVID-19 in the past 14 days?

- Have you been in touch with someone who has reported a fever or respiratory problems in the past 14 days?

- Have you attended gatherings, meetings, or contacted with any unacquainted people in the past 14 days?

If a patient answers "yes" to any of the above-mentioned questions, treatment should be delayed and the patient should be invited to see a physician immediately [11].

All patients should be treated as potential asymptomatic carriers of COVID-19 during a pandemic [25].

### **Precautions in dental practice during COVID-19 pandemic**

#### **Hand hygiene**

Hand hygiene is the most important way to prevent the spread of COVID-19. Dentists are in direct contact with patients, so they have to use hand sanitizers or antiseptics at the beginning and end of every dental procedure [29]. According to the WHO declaration, hand hygiene should be performed either using alcohol-based hand rub or water and soap. Both have similar effects, but if hands are visibly polluted with dirt or any body fluid, it is recommended to prefer water and soap to clean hands rather than alcohol-based hand rubs [16]. This will help to inhibit the transmission of COVID-19 not only to dentists but also to patients [29].

#### **Personal protective equipment (PPE)**

PPE creates an effective block against possible risks caused by aerosols in the operative area.

1- Protective glasses and face shields: These types of equipment have to be used during performing dental treatments in order to prevent aerosols and debris to contaminate eyes and eye corners. Moreover, the equipment should also be disinfected at the end of each patients' visit [16].

2- Face masks: A surgical mask was used when dentists work at a distance of less than 1 meter from the patient. N95, EU FFP2 or an equivalent type of mask should be used during dental procedures to prevent aerosol contamination. Moreover, if an emergency dental treatment is performed for a suspected COVID-19 case, EU FFP3, or an equivalent one that has a higher level of respiratory protection and complies with European Standard 149 should be used [33].

Also, N95 masks can be reusable safely multiple times, depending on a variety of factors such as no exposure to aerosolizing procedures, exceed to dry, or storage in a breathable place in between uses. Many decontaminations and reprocessing methods have been recommended for respirators, such as heating the mask at 70 C° for 30 minutes, that decontaminates efficiently along with protecting filter entirety, precision dosing of UV radiations and hydrogen peroxide vaporization, which is confirmed by FDA as a disinfection method for masks N95 for healthcare personnel during a pandemic [33].

#### **Preprocedural mouth rinse**

Using these rinses is a very effective way to decrease the incidence of microorganisms in the oral cavity. Marui et al. [36] reported that chlorhexidine, essential oils, and cetylpyridinium chloride caused a mean decrease in colony-forming by 68.4% when used during dental procedures. Although the exact effects of preprocedural mouth rinse on COVID-19 are not yet known, chlorhexidine has been demonstrated to be beneficial against

many infectious viruses. Generally, 0.12% chlorhexidine has been used as a preprocedural mouthrinse in dental practice, but if the patient's tongue becomes stained or mucosal irritation or any other side effects occur, 0.05% cetylpyridinium chloride may be an alternative to chlorhexidine [33]. Although oxidation is thought to be vulnerable to COVID-19, 1% hydrogen peroxide solution and 0.2% povidone-iodine mouth rinses have also been found to be effective [25].

### **Radiographs**

Extra-oral imaging methods like panoramic film or cone-beam computed tomography (CBCT) may be preferred to intraoral imaging in order to inhibit gag reflex and cough during intraoral imaging, but if it is necessary to perform intraoral imaging, sensors should be double-covered so that the risk of cross-contamination and perforation may be minimized [16].

### **Rubber dam isolation**

Rubber dam provides barrier protection against aerosols. When performing a cavity, the usage of rubber dam is reported to cause a meaningful 90% decrease in the spread of microorganisms [33].

### **Filter/removal of contaminated air**

HVE and HEPA filters are the most commonly used devices to remove contaminated air from dental operation rooms.

HVE filter provides removing of air up to 2.83 m<sup>3</sup> in 1 minute and it is the simple way to remove aerosols. They can decrease contamination by up to 90% effectively. Nevertheless, the apparatus should be placed at a distance between 6–15 mm from an active ultrasonic tip. The disadvantage of HVE is that it is very hard for a dentist to use it without an assistant. On the other hand, HEPA filter can remove approximately 99.97% of the particles which have a diameter up to 0.3 µm and the disadvantage of HEPA filter is that if microbes hang on it, microorganisms multiply there and enter back into filtered air. Moreover, HEPA filters are difficult to clean and also expensive [33].

### **Medical waste disposal**

Double-layer yellow clinical waste bags with a “gooseneck” node should be used for medical and domestic wastes. Furthermore, the surfaces of these bags should be stickered and they should be disposed with requirements of medical waste disposal [16].

### **Disinfection of surfaces**

As a surface disinfectant, 62–71% ethanol, 0.5% hydrogen peroxide or 0.1% sodium hypochlorite can be used. After each dental treatment, the surfaces, and operating sites around should be cleared well [37].

### **Reducing aerosol production**

During a pandemic, it is advised to remove plaque and calculus manually instead of ultrasonic instrumentation to minimize aerosol production. Moreover, dentists should also prefer to decrease the usage of rotary instruments and try to use either atraumatic restorative procedures or chemomechanical caries removal methods [16].

### **Disposable tools**

Dentists should prefer to use disposable dental equipment such as syringes or mouth mirrors in order to prevent cross-contamination [16].

### **Other clinical tips**

There are several other clinical tips to take care in dental clinics during patient visits in a pandemic. For instance:

- When performing a tooth extraction, the dentist should perform this procedure in a supine position in order to avoid operating in the patient's respiratory tract.
- When dentists try removable partial or fixed dentures to patient, dentist and dental staff should not touch other surfaces in dental clinic after touching patient's saliva.
- All prosthodontics materials like bite registration, dental prosthesis, impressions, must be completely disinfected.
- Salivary suction should be applied very carefully in order to inhibit gag reflex [38].

### **Oral and maxillofacial surgery during COVID-19 pandemic**

Surgeons should follow all of the recommendations mentioned above, as should dentists, to minimize aerosol production. On the other hand, surgeons should prefer conservative treatment methods to maintain both form and function in trauma cases. Closed reduction of fractures should be preferred if it is possible to achieve stability without open reduction. In this way, operation time can also be shortened. If an open reduction is definitely necessary, transcutaneous approach (after performing a bio-occlusive dressing over the mouth after intermaxillary fixation (IMF)) should be performed over an intra-oral approach. Intubation of patients should be done by an experienced anesthesiologist to decrease the number of interferences and also with an implementation that minimizes coughing. Furthermore, the surgical team should enter the operating room 20 minutes later than intubation by wearing PPE masks. When performing open surgery, surgeons should prefer scalpel to monopolar cautery and decrease repeated suction or irrigation, and when dealing with hemostasis surgeons should use bipolar cautery at the lowest power setting. Surgeons should also use absorbable sutures to decrease redundant trips during removal [39].

### **Conclusions**

Consequently, both dentists and dental staff have a high risk of being infected with COVID-19. This pandemic has brought new responsibilities for a dental practice. Implementation of both standards and special precautions could restrain the transmission of COVID-19 from asymptomatic carriers.

### **Scientific Responsibility Statement**

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

### **Animal and human rights statement**

All procedures performed in this study were in accordance with the ethical standards of the international and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

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